



Subdivision B: Toxic Material

Pure Substances and Tested Mixtures

Chronic Toxic Effects

59. A pure substance or tested mixture falls into Subdivision B of Division 2 of Class D - Poisonous and Infectious Material if, in an animal assay for chronic toxic effects, it elicits a response of sufficient severity to threaten life or cause serious permanent impairment in a statistically significant proportion of the test population at

(a) a dose of more than 10 but not exceeding 100 milligrams per kilogram of body weight of the animal per day, when tested in accordance with

(i) OECD Test Guideline No. 408, "Subchronic Oral Toxicity -- Rodent: 90-day", dated May 12, 1981,

(ii) OECD Test Guideline No. 409, "Subchronic Oral Toxicity -- Non-Rodent: 90-day", dated May 12, 1981, or

(iii) the oral route test in OECD Test Guideline No. 452, "Chronic Toxicity Studies", dated May 12, 1981;

(b) a dose of more than 20 but not exceeding 200 milligrams per kilogram of body weight of the animal per day, when tested in accordance with

(i) OECD Test Guideline No. 411, "Subchronic Dermal Toxicity: 90-day", dated May 12, 1981, or

(ii) the dermal route test in OECD Test Guideline No. 452, "Chronic Toxicity Studies", dated May 12, 1981; or

(c) a concentration of more than 25 but not exceeding 250 parts per million by volume of gas or vapour, or more than 10 but not exceeding 100 micrograms per litre or more than 10 but not exceeding 100 milligrams per cubic metre, of dust, mist or fume, when tested in accordance with

(i) OECD Test Guideline No. 413, "Subchronic Inhalation Toxicity: 90-day", dated May 12, 1981, or



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(ii) the inhalation route test in OECD Test Guideline No. 452, "Chronic Toxicity Studies", dated May 12, 1981.

INTERPRETATION / DISCUSSION of SECTION 59

As in section 52, this section deals with chronic toxic effects. These criteria address materials which require a higher dose or concentration level to elicit the specified adverse effect(s).

Refer to the interpretation of section 52 for further information.



Skin or Eye Irritation

60. A pure substance or tested mixture falls into Subdivision B of Division 2 of Class D - Poisonous and Infectious Material if, in an animal assay,

(a) it causes an effect graded at a mean of two or more for erythema formation or two or more for edema formation, when tested in accordance with OECD Test Guideline No. 404, "Acute Dermal Irritation/Corrosion", dated May 12, 1981, as measured at any of the times specified in the test; or

(b) it causes an effect graded at a mean of two or more for corneal damage, one or more for iris damage or 2.5 or more for conjunctival swelling or redness, when tested in accordance with OECD Test Guideline No. 405, "Acute Eye Irritation/Corrosion", dated May 12, 1981, as measured at any of the times specified in the test.

INTERPRETATION / DISCUSSION of SECTION 60

These criteria include materials with which, at concentrations that do not react chemically with biological tissue (i.e. are not corrosive), a recognizable and physiological effect occurs. Although irritation (a physiological effect) and corrosion (chemical reactivity) are distinguishable, in actual fact, many substances may exhibit both properties depending on the concentration and the duration of exposure. Irritants usually generate their effects acutely.

In contrast to corrosive substances, the effects of irritation are generally considered to be reversible. The extent of irritation, especially for the eye, depends on the degree of penetration into the tissue and the severity of the inflammatory response. Unlike sensitization, which is a systemic condition, irritation is a local (topical) phenomenon. In most cases, the effects of irritation ameliorate when the irritant is removed.

Physical abrasives: As any insoluble particulate matter can cause eye or skin irritation, products should not be classified as skin and eye irritants solely on the basis of physical abrasiveness; {ref.: PIS No. 40}.

Irritation versus corrosion - classification?: Materials which fall within the criteria for skin corrosivity will always also meet the criteria for skin and eye irritation. Classification of such materials into both Class E and D2B involves redundancy for D2B information and possible confusion on the part of users. It was agreed, therefore, that materials meeting criteria for Section 65(b), (d), or (e) (Class E - Corrosive Material) need not also be classified under Section 60. However, materials meeting criteria for Section 65(a) (i.e., Metal Corrosives - Class E) which do not meet criteria for Section 65(b), (d), or (e) and do meet Section



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60 criteria (Class D2B - Skin and Eye Irritants) will be classified under both Class E and Subdivision D2B; {ref.: PIS No. 78}. It is anticipated that the *CPR* will, therefore, be amended by replacing the period at the end of paragraph (b) with a semicolon and adding:

"but not,

(c) where the effects described in paragraphs (a) and (b) have been shown to be caused solely by physical abrasiveness due to the presence of insoluble particulates;" nor

(d) where it is a controlled product that meets the criteria referred to in paragraph 65(b), paragraph (d) or paragraph (e).

OECD Test Guideline No. 404, revision: On July 17, 1992, the Council adopted an updated version of the original 1981 OECD guideline 404. The main differences between this and the referenced original version are as follows:

- i) the inclusion of data from *in vitro* tests in the information on which a decision not to proceed to an *in vivo* test can be based; and
- ii) the possibility to use one animal in a first step of the *in vivo* procedure allowing certain chemicals to be exempted from further testing.

The "Initial Considerations" section of the revised OECD guideline 404 states the following:

"In the interests of animal welfare, it is important that the unnecessary use of animals is avoided, and that any testing which is likely to produce severe responses in animals is minimized. Consequently, test materials meeting any of the following criteria should not be tested in animals for dermal irritation/corrosion:

- i) materials that have predictable corrosive potential based on structure-activity relationships and/or physiochemical properties such as strong acidity or alkalinity, e.g., when the material to be applied has a pH of 2 or less or 11.5 or greater (alkaline or acidic reserve¹ should also be taken into account);
- ii) materials which have been shown to be highly toxic by the dermal route;
- iii) materials which, in an acute dermal toxicity test, have been shown not to produce irritation of the skin at the limit test dose level of 2000 mg/kg body weight.

In addition, it may not be necessary to test *in vivo* materials for which corrosive properties are predicted on the basis of results from *in vitro* tests."

¹ Young, J.R., How, M.J. Walker, A.P. and Worth (1988). Classification as corrosive or irritant to skin of preparations containing acidic or alkaline substances without testing on animals. *Toxicology In Vitro*, 2, 19-26.

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OECD Test Guideline No. 405, proposed revision: The “Initial Considerations” section of the March 2000 draft states the following:

“Consideration should be given to all available information on a substance to minimize *in vivo* testing, especially if the substance is likely to produce severe reactions. Therefore, before an *in vivo* eye irritation/corrosion test is performed, all available information on a test material should be reviewed. Preliminary decisions can often be made from existing information as to whether a substance is corrosive or irritating to the eye, or is likely to be irritating or corrosive, in the absence of specific animal testing. Consequently, substances meeting any of the following criteria should not be tested in animals for eye irritation/corrosion without specific justification.

- i) When there is sufficient human data from the test substance, it may not need to be tested in animals.
- ii) Historical experience (including human data) or testing of structurally related chemicals should be evaluated. If there are sufficient data to indicate the eye irritancy/corrosivity potential of a chemical or mixture from analogues, the test substance can be presumed to produce similar responses. SAR experiences should be interpreted cautiously when evaluating non-irritating/corrosive substances.
- iii) Strongly acidic or alkaline substances which can be expected to result in a pH in the eye of 2 or less, or 11.5 or greater, may not need to be tested owing to their probable corrosive properties. Buffering capacity (alkaline or acidic reserve) should also be taken into consideration.
- iv) Substances that have demonstrated severe skin irritancy or corrosivity in a single application dermal study may not need to be tested for eye irritancy and corrosion. It can be presumed that such substances will produce similar severe effects on the eyes.
- v) If a substance is highly toxic by the dermal route, it need not be tested in the eyes because it can be assumed to be highly toxic by this route as well.
- vi) Substances that have demonstrated the potential in an *in vitro* or *ex vivo* study to be corrosive or a severe irritant may not need to be tested for irritation and corrosion *in vivo*. It can be presumed that such substances will produce similar severe effects on the eyes.
- vii) If there is insufficient evidence with which to evaluate the potential eye irritation/corrosivity of a substance from the preceding information, a skin irritation/corrosion test (Guideline 404) should be performed first. If the substance is shown to produce severe skin irritation or corrosion, it can be presumed that it would also produce similar effects in the eyes, so that an *in vivo* eye test need not be performed.
- viii) If a determination of eye irritancy or corrosivity cannot be made using SAR, *in vitro*, or other non-animal procedures, or from the results of a dermal test, an *in vivo* eye test should be considered.”



Skin Sensitization

61. A pure substance or tested mixture falls into Subdivision B of Division 2 of Class D - Poisonous and Infectious Material if

(a) in an animal assay carried out in accordance with OECD Test Guideline No. 406, "Skin Sensitization", dated May 12, 1981,

(i) it produces a response in 30 per cent or more of the test animals, when using one of the techniques incorporating the use of an adjuvant, or

(ii) it produces a response in 15 per cent or more of the test animals, when using one of the techniques not incorporating the use of an adjuvant; or

(b) evidence shows that it causes skin sensitization in persons following exposure in a work place.

INTERPRETATION / DISCUSSION of SECTION 61

For the purposes of classification, "skin sensitization" is a term which is defined by section 32 of the *CPR*. The criteria in this section, therefore, exclude skin sensitization observed **only** in persons who **are** "atopic".

There are two types of criteria in this section. One involves animal testing and the other is evidence observed in workers previously exposed.

OECD Test Guideline No. 406, revision: On July 17, 1992, the Council adopted an updated version of the original 1981 OECD guideline 406. When the *CPR* are next amended, paragraph 61(a) will be modified to refer to the July 17, 1992 version.

According to the general principle of the OECD guideline, test animals are initially exposed to the test substance by intradermal injection and/or epidermal application (induction exposure). Following a rest period of 10 to 14 days (induction period), during which an immune response may develop, the animals are exposed to a "challenge" dose to determine if the test population reacts in a hypersensitive manner. The extent and degree of skin reaction to the challenge exposure in the test population is compared with that of the control population which did not receive the induction exposure.

Atopy / atopic: refer to the discussion under section 56.

Adjuvant / adjuvanticity: Subparagraphs 61(a)(i) and (ii) refer to "adjuvant". Adjuvanticity is the



ability to modify the immune response. An adjuvant is commonly used to elicit a cell mediated immunity (delayed hypersensitivity) as well as antibody formation.

Local Lymph Node Assay (LLNA): is a test method for assessing the skin sensitization potential of chemicals and mixtures. The definition of a positive result in the LLNA is a 3-fold or greater increase in the lymph node cell proliferation over concurrent vehicle control. In the past, positive results from the LLNA were accepted as criteria for classification of a product as a skin sensitizer (D2B). Negative results were not accepted as stand alone criteria when assessing a substance for skin sensitization; i.e., negative results needed to be confirmed by alternate methods such as OECD 406 "Skin Sensitization". The LLNA has been formally adopted by the OECD as Test Guideline No. 429. Under appropriate situations, negative as well as positive LLNA responses can be accepted without the need for further testing in the guinea pig.

- Significant work has been conducted to determine the correlation between LLNA test outcomes and test outcomes in the guinea pig test and in humans. An evaluation of the relevance and reproducibility of the LLNA was conducted by the Interagency Coordinating Committee on the Validation of Alternative Methods (ICCVAM). The method was found to be valid as a stand-alone test for skin sensitization (i.e. for appropriate testing situations, a negative as well as a positive response could be accepted without the need for additional testing in the guinea pig).
- The United States Environmental Protection Agency considers the test to be a satisfactory alternative to existing methods in the guinea pig and prefers the method for skin sensitization testing when there are no reservations to its use as it provides both qualitative and quantitative data and an assessment of dose response.
- The LLNA provides advantages with regard to animal welfare, (most particularly refinement but also reduction), and also scientific aspects (such as the objective and quantitative nature of the end-point measured).
- The LLNA can also provide information on the relative potency of contact sensitizers, unlike other methods currently available.
- The LLNA is suitable for testing coloured substances which are not easily tested in the guinea pig.
- The LLNA is known to produce false negatives for some metals and false positives for some irritants.
- The use of the LLNA is consistent with international trends to accept the test as a stand alone test for skin sensitization.

Subject to human evidence and/or positive results from other studies, when assessing skin sensitization of pure substances or mixtures, the LLNA is acceptable as a "stand alone" method irrespective of whether the results are positive or negative; {ref.: PIS No. 85b}.



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CPR Section 61 - Skin Sensitization [Class D; Division 2, Subdivision B]

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Sensitization: For information on "sensitization" in general and respiratory tract sensitization, refer to the interpretation / discussion corresponding to section 56 of the *CPR*.

Sensitization versus irritation: Skin irritation is distinguishable from skin sensitization on physiological grounds but, in general, such a determination would have to be carried out by an expert.

Sufficiency of evidence - proportion of affected persons: Please see discussion / interpretation of section 56 of the *CPR*.



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CPR Section 62 - Mutagenicity [Class D; Division 2, Subdivision B]

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Mutagenicity

62. A pure substance or tested mixture falls into Subdivision B of Division 2 of Class D - Poisonous and Infectious Material if evidence of mutagenicity in mammalian somatic cells *in vivo* is obtained in a test to assess either gene mutation or chromosomal aberration carried out

(a) in accordance with test methods described in the "Introduction to the OECD Guidelines on Genetic Toxicology Testing and Guidance on the Selection and Application of Assays" published in the Third Addendum to the *OECD Guidelines for Testing of Chemicals*, dated March 1, 1987; and

(b) using testing strategies described in the *Guidelines on the Use of Mutagenicity Tests in the Toxicological Evaluation of Chemicals*, dated 1986, published by authority of the Minister of Health and the Minister of the Environment. [SOR/97-543; s. 25]

INTERPRETATION / DISCUSSION OF SECTION 62

These criteria differ from the previous mutagenicity criteria (Section 57) in that genetic changes are shown to occur in somatic (non-germ) cells. Such changes would *not* be expected to have any effect on subsequent generations. Products included in Class D by virtue of these criteria are, consequently, falls into Subdivision B as opposed to Subdivision A of Division 2 of Class D.



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CPR Section 63 - Untested Mixtures [Class D; Division 2, Subdivision B]

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Untested Mixtures

63. An untested mixture falls into Subdivision B of Division 2 of Class D - Poisonous and Infectious Material if it contains a product, material or substance that meets any of the criteria applicable to a pure substance or tested mixture referred to in any of sections 59 to 62 and is present at a concentration of one per cent or more.

INTERPRETATION / DISCUSSION OF SECTION 63

Where a mixture has not been tested as a whole to determine its health hazards, for the purposes of classification, the mixture is assumed to present the same hazards as the components comprising a specified percentage of the mixture. The percentage specified (0.1 versus 1.0%) depends upon the hazard under consideration.

This section establishes that an untested mixture that contains at least one ingredient, at 1% or greater, that meets any of the criteria within the previous four sections for chronic toxic effects, skin or eye irritation, skin sensitization and mutagenicity, respectively, is also included in Subdivision B of Division 2 of Class D.

A cut-offs of 1.0% is also specified in the United States OSHA Hazard Communication Standard.



Division 3: Biohazardous Infectious Material

64. An organism that has been shown to cause disease or to be a probable cause of disease in persons or animals and the toxins of that organism shall be included in Division 3 of Class D - Poisonous and Infectious Material. [SOR/2010-38; s. 3]

DISCUSSION OF SECTION 64

An organism that causes disease in persons or animals as well as the toxins of such organisms are included in Division 3 of WHMIS Class D. A material which contains such an organism and/or its toxin and is sold or imported into Canada for the reason that the organism or its toxin is present is subject to the WHMIS requirements of the HPA.

The SJCSR had concluded that the HPA does not provide the authority for section 64 of the CPR to state that "an organism that has been shown to cause disease or is reasonably believed to cause disease in persons or animals and the toxins of such an organism fall in Division 3 of Class D...." Therefore, this section was amended through SOR/2010-38 which came into effect on February 23, 2010.

As for the *Pest Control Products Regulations*, for the purposes of Division 3 of WHMIS Class D, "organism means any biological entity living or non-living, cellular or non-cellular". Thus, the criteria includes a bacterium or a virus "that has been shown to cause disease...".

MSDSs for and labelling of infectious agents: See section 9 and 16, respectively, of the CPR.

Diagnostic specimens: The HPA applies to the sale and importation of a controlled product. Internal distribution of a substance, such as from one hospital to another, both of which operate under the auspices of a given Ministry of Health, is outside of the scope of the HPA/CPR. As for other employer generated substances which are not sold in Canada, enquiries relating to an employer's obligations regarding labelling and other information requirements for diagnostic specimens should be directed to the occupational safety and health agency having jurisdiction.

Transportation of Dangerous Goods: A "Guide to Risk Group Assignments" is included as Appendix 3 in Part 2 of the *Transportation of Dangerous Goods Regulations* as published in the supplement to the *Canada Gazette*, Part II, August 15, 2001.



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CPR Section 64 - Division 3: Biohazardous Infectious Material [Class D]

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World Health Organization (WHO) Risk Groups: An organism is considered to fall within the CPR criteria for biohazardous infectious material if it falls within WHO Risk Groups II, III or IV:

Group	Risk	Description	Examples
1	worker risk - low community risk - low	A microorganism that is unlikely to cause significant human disease.	<i>Bacillus subtilis</i> ; <i>Escherichia coli</i> , (non-toxigenic strains)
2	worker risk- moderate community risk - limited	A pathogen that can cause human disease but is unlikely to be a serious hazard to workers or the community. Workplace exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of the pathogen is limited.	mumps virus; Salmonella; <i>Trichinella spiralis</i>
3	worker risk - high community risk - low	A pathogen that usually produces serious human disease but where the pathogen does not ordinarily spread by casual contact from one infected individual to another.	Hantavirus; HIV; <i>Mycobacterium tuberculosis</i>
4	worker risk - high community risk - high	A pathogen that usually produces very serious disease in humans, is often untreatable, and the pathogen may be readily transmitted from one individual to another, directly or indirectly.	Ebola virus; Lassa virus; Marburg virus

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CLASS E – CORROSIVE MATERIAL

65. A product, material or substance shall be included in Class E - Corrosive Material listed in Schedule II to the Act if

- (a) it corrodes SAE 1020 steel or 7075-T6 non-clad aluminum surfaces at a rate exceeding 6.25 millimetres per year at a test temperature of 55°C when tested in accordance with *Test Method, Laboratory Corrosion Testing of Metals for the Process Industries*, NACE Standard TM-01-69 (1976 Revision);**
- (b) it is corrosive to skin when tested in accordance with OECD Test Guideline No. 404, "Acute Dermal Irritation/Corrosion", dated May 12, 1981;**
- (c) it is included in Class 8 in Part III of the *Transportation of Dangerous Goods Regulations*;**
- (d) it is a gas included in Division 4 of Class 2 in Part III of the *Transportation of Dangerous Goods Regulations*;**
- (e) there is evidence that it causes visible necrosis of human skin tissue; or**
- (f) it is an untested mixture containing a product, material or substance that meets the criteria referred to in paragraph (b) or (e) and is present at a concentration of at least one per cent.**

INTERPRETATION / DISCUSSION of SECTION 65

The criteria in this section address the corrosive properties of a product, material or substance on biological tissue (human and laboratory animal) as well as on metal. The WHMIS criteria also includes "goods" in Class 8 and 2.4 of the *TDG Regulations*.

Concrete and concrete mixtures: Unhardened concrete has been shown to pose a significant hazard to workers in terms of its corrosive properties. The sale/importation of concrete mixtures is not exempt from *HPA/CPR* requirements; {ref.: PIS No.21}.

Corrosion versus irritation - classification?: Refer to the interpretation / discussion corresponding to section 60 of the *CPR*.

pH as a criterion for inclusion in Class E: OECD Test Guideline No. 404 states that: "Strongly acidic or alkaline substances, for example, with a demonstrated pH of 2 or less or 11.5 or greater, need not be tested for primary dermal irritation, owing to their predictable corrosive properties". This infers that such

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substances may be viewed as corrosive based simply on a pH test and need not be subject to the full test in accordance with the guidelines. Therefore, (to avoid discrepancies in classifying controlled products) it is recommended that a product, material or substance with a demonstrated pH of 2 or less or 11.5 or greater be considered to be included in Class E, unless test data in accordance with OECD Guideline 404, **or**, as per subparagraph 33(3)(b)(v) of the *CPR*, any other test or method that is carried out in accordance with generally accepted standards of good scientific practice demonstrates this is not to be the case; {ref.: PIS No.60}. It is anticipated that the *CPR* will be amended to explicitly state that a material within this pH range is included in WHMIS Class E unless there is evidence which demonstrates that the material is not corrosive.

Use of *in vitro* methods: The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) permits the use of a U.S. Department of Transport-approved *in vitro* method for evaluating skin corrosivity for compliance of OSHA's Hazard Communication Standard. As reflected in the "Harmonized Integrated Hazard Classification System for Human Health and Environmental Effects of Chemical Substances - Harmonized System for the Classification of Chemicals which cause Skin Irritation/Corrosion" (OECD, November 1998), when considering results from *in vitro* methods, a hierarchal approach has been agreed upon internationally. When considering results from *in vitro* methods, (such as, for example, "CORROSITEX[®]"), as agreed to for the Globally Harmonized System, a positive result constitutes criteria for inclusion in WHMIS Class E; negative or inconclusive results cannot be considered the sole basis for classification and further testing may be required; {ref.: PIS No. 60}.

Paragraph 65(a):

The NACE standard referenced in this paragraph does not specify the concentration of the solution to be used when determining whether or not a solid meets this criterion. In order to have a common baseline, should a supplier wish to use the NACE method for solids, it is recommended that a saturated solution be used, i.e., not a solution based on the recommended usage.

Regarding the duration of this test, many corrosion resistant materials form a protective layer. Short duration tests on such materials would indicate a high corrosion rate which may be very misleading. Short duration tests can also give misleading results on alloys that form passive films such as some stainless steels. For such materials, a more prolonged test may be required to permit the breakdown of the passive layer. Tests run for a longer period may provide a more accurate indication of the corrosivity of a substance than tests run for shorter periods.

Paragraph 65(b):

The referenced OECD guideline specifies pH ranges. See above for information regarding "pH as a criterion for inclusion in Class E".

Paragraph 65(c):

As with the Canadian *TDGR*, the U.S. Department of Transport's (DOT) regulations are based on the United Nations Recommendations on the Transport of Dangerous Goods. Following DOT's authorization of the use of CORROSITEX to determine classification and packing groups for Class 8 hazards, the seventh session of the U.N. Subcommittee of Experts on the Transport of Dangerous Goods voted to delete the word "animal" in paragraph 8.3 of the U.N. recommendations, thereby

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permitting *in vitro* tests to be used internationally.

Paragraph 65(d):

Refer to the interpretation / discussion corresponding to subsection 43(4) for information regarding amendments to the *TDGR* which affected the TDG classification of substances originally included in TDG 2.4 when the *CPR* came into effect.

Paragraph 65 (f):

Where a mixture has not been tested as a whole to determine its health hazards, for the purposes of classification under this section of the *CPR*, the mixture is assumed to present the same hazards as any component meeting the criteria in paragraphs (b) or (e) if that component comprises 1.0% or greater of the untested mixture.

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CLASS F – DANGEROUSLY REACTIVE MATERIAL

66. A product, material or substance shall be included in Class F - Dangerously Reactive Material listed in Schedule II to the Act if it

- (a) undergoes vigorous polymerization, decomposition or condensation;**
- (b) becomes self-reactive under conditions of shock or increase in pressure or temperature; or**
- (c) reacts vigorously with water to release a gas that has an LC₅₀ not exceeding 2,500 parts per million by volume of gas, when tested for four hours in accordance with OECD Test Guideline No. 403, "Acute Inhalation Toxicity", dated May 12, 1981.**

INTERPRETATION / DISCUSSION of SECTION 66

In order to accurately assign a substance to Class F, there must be a clear understanding of the physical and chemical properties influencing reactivity. The degree of saturation, proximity of unsaturated bonds to each other, chemical composition and stability should all be considered. *Bretherick's Handbook of Reactive Chemical Hazards* {Brethrick, L. 1990. 4th ed.} may provide a useful reference in the assessment of chemicals against the WHMIS Class F criteria. The criteria described in paragraphs (a) to (c) correlate with the definitions of "unstable (reactive)" and "water-reactive" in the OSHA Hazard Communication Standard.

Gas versus vapour - inclusion in Class F?: Section 66 covers a wide range of chemically reactive materials, including self-reactive materials and substances which react with water to form a toxic gas as described by paragraph 46(c) of the *CPR*. At present, section 66 correlates only with paragraph 46(c); i.e., paragraph 66(c) refers only to emissions of a "gas" in contact with water or water vapour. This implies the exclusion of flammable vapours and vapours with an LC₅₀ not exceeding 1,500 ppm as per paragraph 46(d) and vapours with an LC₅₀ between 1,500 and 2,500 ppm as per paragraph 49(c) of the *CPR*. Therefore, it has been agreed that section 66 of the *CPR* be amended to include the following two paragraphs:

"(d) reacts vigorously with water to release a vapour that has an LC₅₀ not exceeding 1,500 ppm by volume of vapour, when tested for four hours in accordance with OECD Test Guideline 403, "Acute Inhalation Toxicity", dated May 12, 1981, and a saturated vapour concentration at normal atmospheric pressure greater than two times the value of that LC₅₀"; or

(e) reacts vigorously with water to release a vapour that has an LC₅₀ of more than 1,500 but not exceeding 2,500 ppm by volume of vapour, when tested for 4 hours in accordance with OECD Test Guideline No. 403, "Acute Inhalation Toxicity", dated May 12, 1981, and a saturated vapour concentration at normal atmospheric pressure of more than 0.4 times the LC₅₀"; {ref.: PIS No. 67}.



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CPR Section 66 - Class F -- Dangerously Reactive Material

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Paragraph (a):

Many substances can undergo polymerization, condensation or decomposition which are not considered dangerously reactive chemical reactions. The term "vigorous", then, is an integral part of this criterion. Although the term "vigorous" is not defined in the *CPR*, it may be interpreted to mean uncontrolled and potentially hazardous.

Polymerization: Polymerization is a reaction in which one or more small molecules (monomers) combine to form larger molecules (polymers). Uncontrolled reactions can be triggered by a variety of factors including contamination by substances known to initiate polymerization, the presence of oxygen, an increase in temperature and depletion of inhibitors. Styrene, 1,3-butadiene and methyl acrylate are examples of widely used monomers that have the potential to undergo vigorous polymerization.

Condensation: During condensation, a small molecule, such as water or an alcohol, is generated as a by-product when the link is established between two molecules. Polymers can also be produced through condensation which is a type of addition reaction. Polyesters and polyamides are products of condensation reactions in which water is generated as a by-product.

Decomposition: Decomposition is a reaction in which a substance breaks down into two or more substances. Although most of these reactions are not considered hazardous, substances should be classified as dangerously reactive if significant quantities of heat are released or if the decomposition products are hazardous. Many compounds formed through endothermic reactions are "energy-rich" and possess a tendency to vigorously decompose. Often these compounds are unsaturated (such as acetylene).

Paragraph (b):

Some materials become self-reactive when triggered by shock (such as mechanical impact), increases in pressure or increases in temperature. Nitromethane can become self-reactive under all three of the conditions specified in paragraph (b) and has been detonated by high velocity transfer through pipes where flow was obstructed. Chlorine dioxide can become self-reactive and can explode violently if heated.

Paragraph (c):

Next to air, water may be the substance most likely to come into contact with reactive materials. Many compounds will react vigorously with water and release acutely toxic gases.

For example, chlorosulphonic acid, which is used primarily as a sulphonating agent for production of detergents as well as a catalyst, reacts vigorously with water (including water vapour in air) to yield sulphuric acid and hydrogen chloride. This reaction may result in the formation of a dense white acid mist which can be lethal if inhaled. Anhydrous aluminum chloride, another common catalyst used in the production of a wide range of organic compounds, can also react vigorously with water releasing heat and hydrogen chloride.